UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-4005

October 3, 2006

Mr. George A. Williams
Site Vice President
Grand Gulf Nuclear Station
P.O. Box 756
Port Gibson, MS 39150

SUBJECT: INSPECTION REPORT 050-00416/06-013; 072-00050/06-002

Dear Mr. Williams,

An NRC inspection was conducted on September 13-15, 2006 at your Grand Gulf Nuclear Station. The purpose of the inspection was to observe the fluid operations segment of your Independent Spent Fuel Storage Installation (ISFSI) pre-operational testing program. The canister loading activities observed included canister pressure testing, draining, moisture removal and helium backfilling. The canister unloading activities observed included canister shell cooling with the Supplemental Cooling System, canister shell cooling with annulus flushing, canister gas cooling, canister gas sampling and canister reflooding. The enclosed inspection report documents the results of that inspection, which were discussed with members of your staff during the exit meeting on September 15, 2006.

The inspection determined that you are conducting pre-operational testing activities in compliance with the Commission's rules and regulations and within the conditions of your license as they relate to pre-operational testing activities. No violations were identified.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Should you have any questions concerning this inspection, please contact the undersigned at (817) 860-8191 or Mr. Scott Atwater at (817) 860-8286.

Sincerely,

D. Blair Spitzberg, Ph.D., Chief
Fuel Cycle and Decommissioning Branch

Docket Nos.: 50-416 / 72-050
License No.: NPF-29

Enclosure: NRC Inspection Report
050-00416/06-013; 072-00050/06-002

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ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket Nos.:	050-00416; 072-00050
License No.:	NPF-29
Report No:	050-00416/06-013; 072-00050/06-002
Licensee:	Entergy Operations, Inc.
Facility:	Independent Spent Fuel Storage Installation Grand Gulf Nuclear Station Entergy Operations, Inc. P.O. Box 756 Port Gibson, MS 39150
Dates:	September 13-15, 2006
Inspector:	S.P. Atwater, Health Physicist
Approved By:	D.B. Spitzberg, Ph.D., Chief Fuel Cycle and Decommissioning Branch
Attachments:	1. Supplemental Information 2. Inspector Notes

EXECUTIVE SUMMARY

Grand Gulf Nuclear Station
NRC Inspection Report 050-00458/05-013; 072-00049/05-002

Holtec Certificate of Compliance 72-1014, Amendment 2, License Condition 10 required the licensee to conduct pre-operational testing of the loading, closure, handling, unloading, and transfer of the HI-STORM 100 cask system prior to first use of the system to load spent fuel assemblies. License Condition 10 consisted of eleven subsections lettered a through k. On September 13-15, 2006 Grand Gulf completed the pre-operational testing activities required by License Conditions 10.f, 10.g, and 10.k using mockups of the canister and transfer cask.

License Condition 10.f required pre-operational testing of canister loading operations. These operations included canister welding, nondestructive examination (NDE) inspections, pressure testing, draining, moisture removal and helium backfill. Canister welding and NDE inspections were performed during the welding segment of the pre-operational testing program and were documented in Inspection Report 050-00416/06-009; 072-00050/06-001 (ML061000731). Canister pressure testing, draining, moisture removal, and helium backfilling were performed during this inspection.

License Condition 10.g required pre-operational testing of the Supplemental Cooling System. The Supplemental Cooling System was tested during this inspection.

License Condition 10.k required pre-operational testing of canister unloading operations. These included cooling fuel assemblies, flooding the canister cavity, and removing the canister lid welds. Cooling of the fuel assemblies (including gas sampling) and flooding the canister cavity were performed during this inspection. Removing the canister lid welds was performed during the welding segment of the pre-operational testing program and was documented in Inspection Report 050-00416/06-009; 072-00050/06-001 (ML061000731).

Details related to the activities observed during this inspection are provided in Attachment 2 to this report. The following is a summary of the major activities observed.

- Moisture was successfully removed from the canister using the Forced Helium Dehydration (FHD) system. The degree of canister dryness and the helium backfill pressure and density required by the technical specifications were achieved (Attachment 2, Canister Drying & Inerting).

- Pre-operational testing of the Supplemental Cooling System was successfully performed, as required by License Condition 10.g (Attachment 2, Canister Shell Cooling).

- The written procedures used during this phase of pre-operational testing were consistent with the technical basis described in the Final Safety Analysis Report (FSAR), as required by License Condition 2 (Attachment 2, General License).

- The licensee demonstrated the ability to prevent boiling of the water inside the canister through use of time-to-boil calculations and successful testing of the water recirculation system (Attachment 2, Loading Operations).

- Canister hydrostatic pressure testing met the requirements of the American Society of Mechanical Engineers (ASME) code, as required by the FSAR (Attachment 2, Pressure Testing).

- The ALARA (As Low As Reasonably Achievable) measures required for maintaining personnel exposures within the limits of 10 CFR 20 were established and demonstrated during the testing. Contamination control measures were well considered and practiced and mock-ups of criticality monitors were used. Radiation protection personnel demonstrated in-depth knowledge of the radiological control practices required for dry fuel storage operations (Attachment 2, Radiation Protection).

- The pre-operational testing activities required by License Conditions 10.f and 10.g for canister loading operations were successfully completed (Attachment 2, Training).

- The pre-operational testing activities required by License Condition10.k for canister unloading operations were successfully completed (Attachment 2, Unloading Operations).

ATTACHMENT 1

Supplemental Information

PARTIAL LIST OF PERSONS CONTACTED

Grand Gulf Personnel:

R. Capps - Fuel Services Mechanic
J. Clements - Radiation Protection Supervisor
D. Hall - Fuel Services Mechanic
D. Ellis - Senior Project Manager
J. Jones - Radiation Protection Supervisor
OB Magee - Dry Fuel Services Supervisor
H. Neely - Fuel Services Mechanic
H. Nelson - Fuel Services Electrician
J. Owens - Senior Licensing Specialist
T. Pate - Fuel Services Electrician
S. Raner - Fuel Services Mechanic
V. Scott - Fuel Services Boilermaker
T. Thurmon - QA Auditor

Contractor Personnel:

R. Anderson - Fuel Services - Stone and Webster
A. Banks - Fuel Services - Stone and Webster
L. Ruff - Training - Enercon
G. Smith - Fuel Services - Stone and Webster
K. Stewart - Fuel Services - Atlantic Group

Entergy Personnel:

J. Campbell - Fuel Services - River Bend Station
B. Smith - Fuel Services - River Bend Station

INSPECTION PROCEDURES USED

60854	Preoperational Testing of an Independent Spent Fuel Storage Installation (ISFSI)
60854.1	Preoperational Testing of ISFSIs at Operating Plants

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened

None

Closed

None

Discussed

None

LIST OF ACRONYMS USED

ALARA	As Low As Reasonably Achievable
ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulations
CoC	Certificate of Compliance
DFS	Dry Fuel Storage
EAD	Electronic Alarming Dosimeter
FHD	Forced Helium Dehydration
FME	Foreign Material Exclusion
FSAR	Final Safety Analysis Report
GWD/MTU	Gigawatt Days per Metric Ton Uranium
HEPA	High Efficiency Particulate Airborne
ISFSI	Independent Spent Fuel Storage Facility
kW	Kilowatt
MPC	Multi-Purpose Canister
NDE	Non-Destructive Examination
NRC	U.S. Nuclear Regulatory Commission
RVOA	Removable Valve Operating Assembly
RWP	Radiation Work Permit
SCS	Supplemental Cooling System

Attachment 2

GRAND GULF FLUID OPERATIONS DEMONSTRATION
Inspector Notes

Category: Canister Drying & Inerting **Topic:** Dryness Levels

Reference: CoC 1014, Tech Spec A.3.1.1.1 and Table 3-1

Requirement When using the Forced Helium Dehydration (FHD) system for canister drying, the gas temperature exiting the demoisturizer shall be 21 degrees F or less, for 30 minutes or more. Alternately the gas dew point exiting the canister shall be 22.9 degree F or less, for 30 minutes or more.

Finding: This requirement was implemented. Final drying of the canister was performed in accordance with Section 6.12 of Procedure 20-S-01-140. Step 6.12.15 stated that the canister was dry when the gas temperature exiting the demoisturizer (ice filter) was at or below 19 degrees F, OR the gas dew point exiting the canister (FHD inlet) was at or below 20.5 degrees F. These specifications were within the technical specification gas temperature limits of 21 degrees F and 22.9 degrees F respectively.

Procedure 20-S-01-140, Step 6.12.11 started the technical specification 30-minute time clock when the helium exiting the canister reached a dew point of 20.5 degrees F. At that time, the temperature of the helium exiting the demoisturizer (ice filter) was verified to be 19 degrees F or less. After 30 minutes had elapsed with no increase in temperature or dew point, Step 6.12.14 declared the canister dry.

Documents Reviewed: Procedure 20-S-01-140, "DFS MPC Forced Helium Drying Operations", Revision 0

Category: Canister Drying & Inerting **Topic:** Forced Helium Dehydration (FHD)

Reference: CoC 1014, TS A.3.1.1.1; Table 3-1; B.3.6.1

Requirement For canisters containing one or more fuel assemblies with burnup values greater than 45 GWD/MTU, forced helium dehydration must be used for canister drying. For all other canisters, either forced helium dehydration or vacuum drying may be used for canister drying.

Finding: This requirement was implemented. Grand Gulf elected to use Forced Helium Dehydration (FHD) and Procedure 20-S-01-140 for all canister drying operations. During phase 1 of FHD, water was boiled and carried out of the canister by heated helium. During pre-operational testing, the equilibrium helium temperatures were 396 degrees F at the outlet of the FHD system heater, 363 degrees F entering the canister, and 240 degrees F returning from the canister. System differential pressure was approximately 10 psi and overall system pressure was maintained between 20 and 60 psig. Phase 1 continued until water no longer collected in the accumulator and the inlet and outlet dew points were within 2 degrees F of each other. At the completion of phase 1, the inlet dew point was 95.3 degrees F and the outlet dew point was 95.6 degrees F.

During phase 2 of FHD, the last remaining moisture was driven out of the canister using a refrigeration cycle. The FHD system heater was left in operation and the chiller unit was started. The technical specification 30-minute time clock was started when the helium exiting the canister reached a dew point of 20.5 degrees F. At that time, the temperature of the helium exiting the demoisturizer (ice filter) was verified to be 19 degrees F or less. After 30 minutes had elapsed with no increase in temperature or dew point, phase 2 was complete and the canister was dry.

Documents Reviewed: Procedure 20-S-01-140, "DFS MPC Forced Helium Drying Operations", Revision 0

Category: Canister Drying & Inerting **Topic:** Helium Pressure or Density

Reference: CoC 1014, Tech Spec A.3.1.1.2 and Table 3-2

Requirement Verify canister helium backfill density or pressure is within the limit specified in Table 3-2. For helium backfill of the MPC-68, verify backfill pressure is between 29.3 psig and 33.3 psig (inclusive) at a reference temperature of 70 degrees F, OR verify canister helium backfill density is 0.1218 +0/-10% g-moles/l.

Finding: This requirement was implemented. The canister was backfilled with helium using Section 6.13 of Procedure 20-S-01-140. The technical specification required a helium backfill pressure of 29.3 to 33.3 psig at a reference temperature of 70 degrees F. Since the helium used for backfilling was circulating in the canister at temperatures much higher than 70 degrees F, a conversion was needed to determine the equivalent pressure range at these higher gas temperatures. A backfill pressure chart was provided in Attachment III to Procedure 20-S-01-140. This chart converted the 29.3 - 33.3 psig at 70 degrees F to equivalent pressure ranges at temperatures up to 345 degrees F.

Procedure 20-S-01-140, Step 6.13.4 selected the target backfill pressure from Attachment III based on the canister helium inlet and outlet temperatures. During the pre-operational testing, equilibrium canister inlet temperature was 265 degrees F and canister outlet temperature was 262 degrees F. For these temperatures, the backfill pressure chart yielded a target backfill pressure of 46.2 - 49.3 psig. The final helium backfill pressure was 48.0 psig, as documented in Step 6.13.9 of Procedure 20-S-01-140.

Documents Reviewed: Procedure 20-S-01-140, "DFS MPC Forced Helium Drying Operations", Revision 0

Category: Canister Shell Cooling **Topic:** High Burnup Fuel

Reference: CoC 1014, Tech Spec A.3.1.4

Requirement Whenever a canister containing one or more spent fuel assemblies with average burnup values greater than 45 GWD/MTU is inside the transfer cask, the canister shell must be cooled using the Supplemental Cooling System (SCS). The SCS must be placed in operation within 4 hours of completion of canister drying operations during loading, or within 4 hours of transferring the canister

into the transfer cask during unloading. Once steady state operation is achieved, the SCS may be disabled for up to 7 hours to facilitate operational evolutions.

Finding: This requirement was implemented. Canister shell cooling with the Supplemental Cooling System (SCS) was performed in accordance with Procedure 20-S-01-150. Step 6.3.1 of the procedure required the SCS to be in operation within 4 hours of completion of canister drying operations during loading, or within 4 hours of transferring the canister into the transfer cask during unloading.

During both the loading and unloading operations, the transfer cask annulus was filled with demineralized water and drained repeatedly until canister shell temperature decreased to 180 degrees F or less. This prevented steam binding in the suction of the SCS pump. Once the shell was cooled sufficiently, the SCS pump was started. The flowpath was from the pump, through the radiator, to the spray ring on top of the annulus, down along the canister shell, out the pool lid drain at the bottom of the transfer cask, and back to the SCS pump. Flow was continued until the SCS pump inlet temperature was changing less than 2 degrees F every 15 minutes. Procedure 20-S-01-150 defined this condition as steady state operation.

Documents Reviewed: Procedure 20-S-01-150, "DFS Supplemental Cooling System Operations", Revision 0

Category: Canister Shell Cooling **Topic:** Moderate Burnup Fuel

Reference: FSAR 1014, Section 8.3.3.3 Warning

Requirement Whenever a canister containing spent fuel assemblies with average burnup values less than 45 GWD/MTU is inside the transfer cask, use of the Supplemental Cooling System (SCS) to cool the canister shell is not required. Instead, the canister shell may be cooled with a water flush for a minimum of 33 hours at 10 gpm, or as specified for the particular heat load.

Finding: This requirement was implemented. Canister shell cooling using a water flush was performed in accordance with Procedure 20-S-01-004. In the bottom-to-top mode of flushing, demineralized water was supplied to the bottom of the transfer cask annulus through the pool lid drain, flowed upward along the canister shell removing heat, and overflowed out the top of the annulus to the cask washdown area floor drain. In the top-to-bottom mode of flushing, demineralized water was supplied to the top of the transfer cask annulus through the spray ring, flowed downward along the canister shell removing heat, exited the annulus through the pool lid drain at the bottom, and flowed to the cask washdown area floor drain.

In both modes of flushing, when the average temperature between the water inlet and outlet reached 100 degrees F at 10 gpm, the remaining flush time was determined. For canisters with decay head loads of 10.5 kW or less, the minimum cooling times were provided in a table in Step 6.14.15 of Procedure 20-S-01-004. For canisters with decay head loads greater than 10.5 kW, the flush was continued for a minimum of 33 hours.

Documents Reviewed:	Procedure 20-S-01-004, "DFS Cask Unloading", Revision 0

Category: General License **Topic:** Written Procedures Required

Reference: CoC 1014, Condition 2

Requirement Written operating procedures shall be prepared for cask handling, loading, movement, surveillance and maintenance. The user's site-specific written operating procedures shall be consistent with the technical basis described in Chapter 8 of the FSAR.

Finding: This requirement was implemented for the activities performed during this phase of pre-operational testing. The procedures used are listed below in the documents reviewed section. The procedures were generally well written and the directions were clear and specific. Notes and warnings were clearly identified and appropriately placed. Procedure adherence and placekeeping were consistent.

Documents Reviewed:
Procedure 20-S-01-002, "DFS Cask Loading", Revision 0
Procedure 20-S-01-004, "DFS Cask Unloading", Revision 0
Procedure 20-S-01-006, "DFS Radiological Monitoring Requirements for the HI-STORM 100 Dry Fuel Storage System", Revision 0
Procedure 20-S-01-009, "MPC Water Recirculation", Revision 0
Procedure 20-S-01-140, "DFS MPC Forced Helium Drying Operations", Revision 0
Procedure 20-S-01-150, "DFS Supplemental Cooling System Operations", Revision 0

Category: Loading Operations **Topic:** Time to Boil Limit

Reference: FSAR 1014, Section 4.5.1.1.5 and Table 4.5.6

Requirement Water inside the canister cavity is not permitted to boil. The maximum duration that fuel may be submerged in water between canister removal from the pool and the start of vacuum drying operations is a function of canister decay heat load and initial water temperature. The maximum duration for a canister with a bounding decay heat load of 28.74 kW is provided in Table 4.5.6 of the FSAR for various initial water temperatures. For lower decay heat load canisters, the maximum duration must be calculated. If the maximum allowable duration is insufficient, a forced water circulation shall be initiated and maintained to remove decay heat from the canister cavity.

Finding: This requirement was implemented. Once the lid is installed on the canister in the spent fuel pool, the water inside the canister will start heating up. The time needed for boiling to start inside the canister is known as the time-to-boil. Procedure 20-S-01-002, Attachment 1 contained the equation for calculating the time-to-boil based on initial water temperature and canister heat load. Calculations had been pre-performed for various combinations of canister heat loads and initial spent fuel pool temperatures, and had been provided in Attachment 1.

The licensee determined the time-to-boil twice during the canister closure

sequence. The first time-to-boil was calculated in Step 6.8.13 of Procedure 20-S-01-002 when the canister lid was installed. Spent fuel pool temperature was used as the initial water temperature in this calculation. The second time-to-boil was calculated in Step 6.13.11 when approximately 50 gallons of water was removed from the canister in preparation for canister welding. The temperature of the water exiting the canister was used in this calculation.

If either calculation indicated that less than 12 hours remained until boiling, the operator was directed to Procedure 20-S-01-009 to set up the water recirculation system for operation. If less than 4 hours remained until boiling, the operator was directed to place the water recirculation system in operation. During pre-operational testing, the licensee simulated that less than 4 hours remained until boiling, and entered Procedure 20-S-01-009. Both the dual-pump mode and the single-pump mode of recirculation were demonstrated.

The dual-pump mode of recirculation would be used if the canister lid-to-shell weld root pass was not complete when the time-to-boil limit was reached. In this mode, the supply pump took a suction from the spent fuel pool and discharged cool water into the canister through the canister drain port. The return pump took a suction from the canister vent port and discharged the heated water back to the spent fuel pool. The return pump was operated at a slightly higher flow rate than the supply pump to prevent overflowing the canister through the lid-to-shell gap. Canister water level could not decrease below the level of the vent port before the return pump would lose suction.

The single-pump mode of recirculation would be used if the canister lid-to-shell weld root pass was complete when the time-to-boil limit was reached. In this mode, the supply pump took a suction from the spent fuel pool and discharged cool water into the canister through the canister drain port. Since the canister was sealed, canister internal pressure forced the heated water out the canister vent port and back to the spent fuel pool. A return pump was not needed.

Documents Reviewed: Procedure 20-S-01-002, "DFS Cask Loading", Revision 0
Procedure 20-S-01-009, "MPC Water Recirculation", Revision 0

Category: Pressure Testing **Topic:** Governing Code

Reference: FSAR 1014, Section 9.1.2.2.2

Requirement Pressure testing (hydrostatic or pneumatic) of the canister confinement boundary shall be performed in accordance with the requirements of ASME Code Section III, Subsection NB, Article NB-6000, when field welding of the canister lid-to-shell weld is completed. If hydrostatic testing is used, the canister shall be pressure tested to 125% of design pressure. If pneumatic testing is used, the canister shall be pressure tested to 120% of design pressure.

Finding: This requirement was implemented. Grand Gulf elected to use the hydrostatic method for pressure testing of the canister confinement boundary welds. The hydrostatic testing was performed in accordance with Procedure 20-S-01-002, which incorporated the applicable requirements of ASME Code Section III, Subsection NB, Article NB-6000. The FSAR required a hydrostatic test pressure

of 125% of canister design pressure. The MPC-68 canister design pressure was 100 psig and the hydrostatic test was conducted at 126 to 129 psig.

Documents Reviewed: Procedure 20-S-01-002, "DFS Cask Loading", Revision 0

Category: Pressure Testing **Topic:** Hydrostatic Testing Sequence

Reference: FSAR 1014, Sections 8.1.5.4; 9.1.2.2.2

Requirement During hydrostatic testing, the canister vent and drain port caps are open and the RVOAs are installed. Demineralized water or spent fuel pool water is admitted to the canister through a supply line connected to the drain port RVOA. The canister is pressurized to 125 +5/-0 psig and held for a minimum of 10 minutes with no pressure drop. Following the 10-minute hold at test pressure, the canister lid-to-shell weld is visually examined to confirm no observable water leakage. The canister is then depressurized through a return line connected to the vent port RVOA and the water is routed back to the spent fuel pool or liquid radwaste system. Once the canister is depressurized, the liquid penetrant examination of the canister lid-to-shell weld is repeated. Any evidence of cracking or deformation is cause for rejection.

Finding: This requirement was implemented. Canister hydrostatic testing was performed in accordance with Procedure 20-S-01-002. The RVOAs were installed and the canister vent and drain port caps were left open at all times during the hydrostatic testing.

Attachment IX of Procedure 20-S-01-002 was used to supply demineralized water to the canister through the drain port RVOA, pressurize the canister to between 126 and 129 psig, maintain the test pressure for 10 minutes, and visually examine the canister lid-to-shell weld to confirm no observable water leakage.

Section 6.19 of Procedure 20-S-01-002 was used to release the canister internal pressure through the vent port RVOA to the liquid radwaste system, and to re-perform the lid-to-shell weld liquid penetrant examination.

Documents Reviewed: Procedure 20-S-01-002, "DFS Cask Loading", Revision 0

Category: Pressure Testing **Topic:** Pressure Gauge Installation

Reference: ASME Section III, Article NB-6411

Requirement Pressure test gauges shall be connected directly to the component, and visible to the operator controlling test pressure.

Finding: This requirement was implemented. Grand Gulf used two Ashcroft (Dresser Industries) digital pressure gauges for the canister hydrostatic testing. Sensing lines connected the vent port and drain port RVOAs to the pressure gauges at the hydrostatic testing station. This configuration provided direct gauge visibility to the operator controlling test pressure and reduced his radiation exposure during canister hydrostatic testing.

Documents Reviewed:	None.

Category:	Pressure Testing **Topic:** Pressure Gauge Ranges
Reference:	ASME Section III, Article NB-6412
Requirement	Analog type indicating pressure gauges used in testing shall be graduated over a range not less than 1.5 times nor more than 4 times the test pressure. Digital type pressure gauges may be used without range restriction, provided the combined error due to calibration and readability does not exceed 1 percent of test pressure.
Finding:	This requirement was implemented. Grand Gulf used two Ashcroft (Dresser Industries) digital pressure gauges with a 0-200 psig range and a maximum calibration error of 0.05%. Sensing lines connected the vent port and drain port RVOAs to the pressure gauges at the hydrostatic testing station. This configuration eliminated the readability error.
Documents Reviewed:	None.

Category:	Pressure Testing **Topic:** Thermal Expansion
Reference:	ASME Section III, Article NB-6126
Requirement	If a pressure test is to be maintained for a period of time and the test medium in the system is subject to thermal expansion, precautions shall be taken to avoid excessive pressure.
Finding:	This requirement was implemented. Pressure testing was performed in accordance with Attachment IX of Procedure 20-S-01-002. The 95 psig relief valve connected to the vent port RVOA was removed and the connection was plugged. Overpressure protection was provided by the 135 psig relief valve connected to the drain port RVOA. This relief valve was un-isolated and in service at all times during the hydrostatic testing.
Documents Reviewed:	Procedure 20-S-01-002, "DFS Cask Loading', Revision 0

Category:	Radiation Protection **Topic:** ALARA Pre-Job Briefings
Reference:	FSAR 1014, Section 10.1.1
Requirement	Pre-job ALARA briefings should be held with workers and radiation protection personnel prior to work on or around the system.
Finding:	This requirement was implemented through a comprehensive pre-job briefing conducted prior to the pre-operational testing and through shorter, more specific pre-job briefings held at the job site prior to each major evolution. The industrial elements of the briefings included task sequence, job assignments, housekeeping, communications, procedure adherence, use of personnel protective equipment, high temperature hazards, trip hazards, confined space hazards, contingencies for most error likely tasks, stop work authority, operating experience, plant conditions, and the remaining time-to-boil. The radiation protection elements of the briefings included Radiation Work

Permit (RWP) use, Electronic Alarming Dosimeter (EAD) settings and placement, simulated dose rates, radiation protection personnel coverage, low dose waiting area locations, airborne activity and contamination controls, and placement of area monitors.

Documents Reviewed: None.

Category: Radiation Protection **Topic:** ALARA Program

Reference: 10 CFR 72.104(b); FSAR 1014, Section 10.1.1

Requirement Operational restrictions must be established to meet ALARA (as low as reasonably achievable) objectives for radioactive materials in effluents and direct radiation levels associated with ISFSI operations. Licensees using the HI-STORM 100 System will apply their existing site ALARA policies, procedures and practices to ISFSI activities to ensure that the personnel exposure limits of 10 CFR 20 are met.

Finding: This requirement was implemented. The mock-up area in the Rotor Storage Building was posted as a High Radiation Area, Contaminated Area, Neutron Radiation Area and Foreign Materials Exclusion (FME) Zone. A low dose waiting area was identified and temporary shielding was used in the transfer cask gap. Area monitors, HEPA filters, and continuous air samplers were used. Radiation protection personnel provided continuous coverage and their contamination control measures were well considered and practiced.

Procedure 20-S-01-006 contained provisions for ensuring criticality monitors were installed and operational. Mock-ups of these monitors were used during the pre-operational testing. Radiation protection personnel demonstrated knowledge of the requirements in Procedure 20-S-01-006 during the testing. The operators understood the importance of the radiation protection role and complied with all directions provided by radiation protection personnel.

Documents Reviewed: Procedure 20-S-01-006, "DFS Radiological Monitoring Requirements for the HI-STORM 100 Dry Fuel Storage System", Revision 0.

Category: Training **Topic:** Dry Run Exercise - Loading

Reference: CoC 1014, Condition 10

Requirement A dry run training exercise of the loading, closure, handling, and transfer of the HI-STORM 100 System shall be conducted by the licensee prior to first use of the system to load spent fuel assemblies. The dry run shall include the operations specified in CoC Condition 10.

Finding: This requirement was implemented for License Conditions 10.f and 10.g. License Condition 10.f required pre-operational testing of canister welding, nondestructive examination (NDE) inspections, pressure testing, draining, moisture removal and helium backfill. Canister welding and NDE inspections were performed during the welding segment of the pre-operational testing program and were documented in Inspection Report 050-00416/06-009; 072-00050/06-001 (ML061000731). Canister pressure testing, draining, moisture removal, and helium backfilling were performed during this inspection.

License Condition 10.g required pre-operational testing of the Supplemental Cooling System (SCS), which was performed during this inspection.

The pre-operational testing was conducted under Work Order 74514 and RWP 2006-2002, Task 01 using draft procedures and mock-ups of the canister and transfer cask. The canister loading sequence started with the canister lid-to-shell weld complete, RVOAs installed, canister filled with water (less 50 gallons), and the Forced Helium Dehydrator (FHD) system purged with helium. The sequence included fill and vent of the canister, a hydrostatic test at 126-129 psig for 10 minutes, a simulated liquid penetrant examination of the lid-to-shell weld, canister blowdown with helium, moisture removal by forced helium dehydration, and helium backfill.

Documents Reviewed: Work Order #74514
RWP 2006-2002, Task 01

Category: Training **Topic:** Dry Run Exercise - Unloading

Reference: CoC 1014, Condition 10.k

Requirement A dry run training exercise of the unloading of the HI-STORM 100 System shall be conducted by the licensee prior to first use of the system to load spent fuel assemblies. The dry run shall include cooling fuel assemblies, flooding the canister cavity, and removing the canister lid welds.

Finding: This requirement was implemented for License Condition 10.k. License Condition 10.k required pre-operational testing of the canister unloading operation including cooling fuel assemblies, flooding the canister cavity and removing the canister lid welds. Cooling of fuel assemblies and flooding the canister cavity were performed during this inspection. Removing the canister lid welds was performed during the welding segment of the pre-operational testing program and was documented in Inspection Report 050-00416/06-009; 072-00050/06-001 (ML061000731).

The pre-operational testing was conducted under Work Order 74514 and RWP 2006-2002, Task 01 using draft procedures and mock-ups of the canister and transfer cask. The canister unloading sequence started with the canister in the transfer cask without the RVOAs installed. The sequence included canister shell cooling using the Supplementary Cooling System (SCS), canister shell cooling using two flushing methods, canister gas sampling, helium cooldown (simulated) and canister reflooding.

Documents Reviewed: Work Order #74514
RWP 2006-2002, Task 01

Category: Unloading Operations **Topic:** Canister Gas Cooling

Reference: CoC 1014, Tech Spec 3.1.3; FSAR Section

Requirement Prior to reflooding the canister, a forced helium recirculation system shall be operated to cool the canister bulk helium temperature to 200 degrees F or less.

Finding: This requirement was implemented. Canister gas cooling was performed using

the Forced Helium Dehydration (FHD) system and Section 6.22 of Procedure 20-S-01-004. The licensee had successfully tested the FHD system during canister drying, and therefore the helium cooldown was simulated.

Documents Reviewed: Procedure 20-S-01-004, "DFS Cask Unloading", Revision 0

Category: Unloading Operations **Topic:** Canister Gas Sampling

Reference: FSAR 1014, Section 8.3.3.7

Requirement During unloading of a cask, gas sampling is performed to assess the condition of the fuel assembly cladding. The gas sample bottle is connected to the vent port RVOA, and the RVOA body and sample bottle are evacuated. The vent port cap is then slowly opened and the gas sample is obtained.

Finding: This requirement was implemented. Gas sampling was performed in accordance with Procedure 20-S-01-004. A stainless steel sampling rig, equipped with isolation valves and a compound pressure gauge, was installed on the canister vent port RVOA. A temperature sensor was inserted into the body of the RVOA and a small vacuum pump was used to evacuate the sample chamber and RVOA housing.

Procedure 20-S-01-004, Step 6.19.9 required evacuating the sample chamber to a minimum of 10" Hg vacuum prior to drawing a gas sample. During pre-operational testing, the sample pump drew 22" Hg of vacuum, at which point the vent port cap was slowly opened and gas was drawn from the canister into the sample chamber. When sample chamber pressure reached 4 psig, the vent port cap was closed and the sampling rig was removed. The sample date, time and temperature were recorded in Step 6.19.6. A HEPA vacuum and high volume (60 lpm) air sampler were in continuous operation during sample collection.

Documents Reviewed: Procedure 20-S-01-004, "DFS Cask Unloading", Revision 0

Category: Unloading Operations **Topic:** Canister Reflooding

Reference: FSAR 1014, Section 8.3.3.8

Requirement Once the canister gas has been cooled to less than 200 degrees F, reflood the canister through the drain port until water issues from the vent port. Ensure the water supply pressure is less than 90 psig.

Finding: This requirement was implemented. During unloading, canister reflooding was performed in accordance with Section 6.23 of Procedure 20-S-01-004. Step 6.23.5 of the procedure confirmed that the final temperature achieved during helium cooldown was less than 190 degrees F. Step 6.23.3 required the reflooding water supply pressure to be less than 90 psig if from a source other than the spent fuel pool.

Step 6.23.10 of Procedure 20-S-01-004 supplied reflooding water to the canister through the drain port. When a solid stream of water issued from the canister through the vent port, reflooding was complete and the time was documented in Step 6.23.12. The water was circulated for a minimum of 20 minutes beyond completion of reflooding.

Documents Reviewed:	Procedure 20-S-01-004, "DFS Cask Unloading", Revision 0